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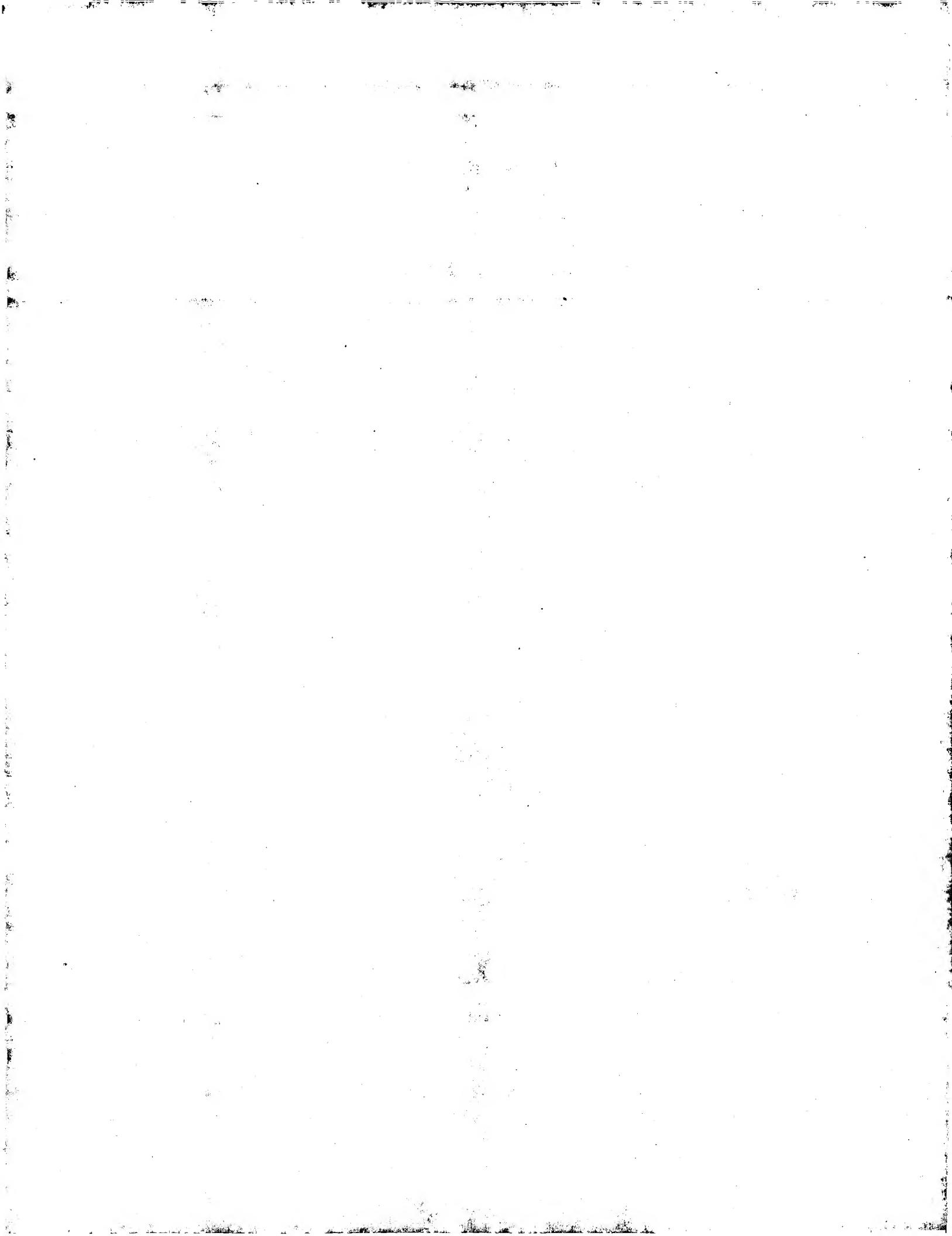
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
4 January 2001 (04.01.2001)

PCT

(10) International Publication Number  
**WO 01/00514 A1**

(51) International Patent Classification<sup>7</sup>: B65H 3/06,  
7/18, 5/34

ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP,  
KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD,  
MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD,  
SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ,  
VN, YU, ZA, ZW.

(21) International Application Number: PCT/GB99/02040

(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM,  
AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT,  
BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,  
NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,  
GN; GW, ML, MR, NE, SN, TD, TG).

(22) International Filing Date: 29 June 1999 (29.06.1999)

Published:

— With international search report.

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant and

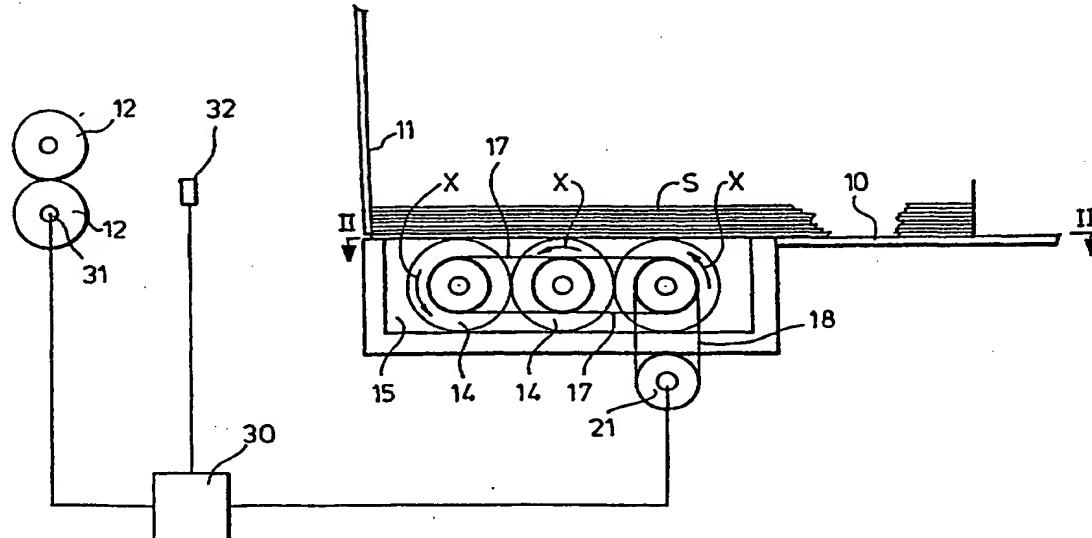
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(81) Designated States (national): AE, AL, AM, AT, AU, AZ,  
BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE,

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS FOR FEEDING SHEET MATERIAL



**WO 01/00514 A1**

(57) Abstract: There is disclosed apparatus for feeding sheet material sequentially on demand to processing machinery having a take-up mechanism (12) comprising a feed table (10) having a gate (11) and upon which sheets (5) may be stacked against the gate (11) which allows only the lowermost sheet to pass therebeneath, means driven by a servo-motor (21) to advance the lowermost sheet beneath the gate (11) to the take-up mechanism (12), a sensing means (32) between the gate (11) and the take-up mechanism (12) to detect the passage of the leading edge of the sheet, a microprocessor (30) which receives data indicating the position of the take-up mechanism (12) and from the sensing means (32) and programmed to control the servo-motor (21) to ensure that the leading edge of the sheet presents itself to the take-up mechanism (12) at the correct instant.

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## APPARATUS FOR FEEDING SHEET MATERIAL

This invention concerns apparatus for feeding sheet material, particularly, though by no means exclusively, of corrugated board or card as used in the box and case making industries.

In general, stacked sheets are placed on a feed table against a gate which allows only the lowermost sheet to pass therebeneath under the action of forwarding means such as a reciprocating vacuum suction cup, feed rollers or a kicker mechanism, to be fed to take-up means such as the nip between take-up rolls or gripper bars for example of a converting machine such as a rotary die cutter.

It is, of course, essential that the leading edge of each sheet is presented to the take-up means at precisely the correct instant in each machine cycle.

To this end prior known sheet feeding apparatus has relied upon the leading edge of each sheet being at a defined position at the commencement of feed. Many factors, including premature movement of a sheet by continuing rotation of feed rollers after the previously fed sheet has cleared them, mechanical tolerances, improper stacking of the sheets on the feed table, sheet quality and even atmospheric conditions can cause the leading edge of a sheet to be displaced from the expected defined position at the commencement of feed.

It is an object of the present invention to provide sheet feeding apparatus which overcomes the difficulties aforesaid.

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According to the present invention there is provided apparatus for feeding sheet material sequentially on demand to processing machinery having a take-up mechanism comprising a feed table having a gate and upon which sheets may be stacked against the gate which allows only the lowermost sheet to pass therebeneath, means driven by a servo-motor to advance the lowermost sheet beneath the gate to the take-up mechanism, a sensing means between the gate and the take-up mechanism to detect the passage of the leading edge of the sheet, a microprocessor which receives data indicating the position of the take-up mechanism and from the sensing means and programmed to control the servo-motor to ensure that the leading edge of the sheet presents itself to the take-up mechanism at the correct instant.

The microprocessor may also be programmed to ensure that the leading edge of the sheet presents itself to the take-up mechanism at a desired speed.

The take-up mechanism may comprise a pair of take-up rolls.

The desired speed may be slightly less than the speed at which the take-up mechanism forwards the sheet.

The take-up mechanism may comprise gripper bars.

The desired speed may be zero.

The means driven by the servo-motor may comprise a bed of rollers within the surface of the table which are rotatably driven to advance the lowermost sheet beneath the gate to the take-up mechanism when forward drive to the rollers is arrested and means to allow the rollers to free-wheel once the lowermost sheet is being advanced thereover by the take-up mechanism.

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The invention will be further apparent from the following description with reference to the figures of the accompanying drawings which show, by way of example only, one form of apparatus embodying same.

Of the drawings:-

Figure 1 shows a side elevation of the apparatus; and

Figure 2 shows a cross-section through the apparatus on the line II-II of Figure 1.

Referring now to the drawings, it will be seen that the apparatus comprises a feed table 10 upon which a stack of sheets S may be placed against a gate 11 beneath which only the lowermost sheet in the stack may pass.

Successive sheets are advanced beneath the gate 11 into the nip of take-up rolls 12 by a bed 13 of rollers 14 within the surface of the table. The take-up rolls 12 forward the successive sheets in timed sequence to processing machinery such as a rotary die-cutter.

The rollers are mounted within a chamber 15 to which vacuum suction is applied to pull the lowermost sheet downwardly thereagainst.

The rollers 14 advance the lowermost sheet by being rotatably driven as indicated by the arrows X. Once the sheet is advanced by the rolls 12 drive to the rollers 14 ceases and they are allowed to free-wheel as the sheet is drawn thereover, the rollers 14 having sprag clutches between their inner peripheries and their drive shafts 16. As

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the next sheet in the stack drops onto the rollers 14 their free-wheeling rotation is arrested.

The drive shafts 16 are rotatably interconnected by timing drive belts 17 and one shaft is driven by a timing belt 18 itself driven intermittently in a forward direction only by a servo-electric motor 21 which stops whilst a sheet is being advanced by the take-up rolls 12 and which operates at a timed sequence demanded by the processing machinery.

In accordance with the invention the servo-motor 21 is controlled by a microprocessor 30 which receives data from a pulsed shaft encoder 31 indicating the rotational position of the take-up rolls 12 and also from a sensing means comprising a high speed fibre optic sensor 32 between the gate 11 and take-up rolls 12 detecting passage of the leading edge of a sheet being fed.

The microprocessor 30 is programmed to control the servo-motor 21 to ensure that the leading edge of each sheet presents itself at the nip between the rolls 12 at precisely the correct instant and at a desired speed.

It will be understood that the exact position of the leading edge of any sheet at the commencement of feed is immaterial, since control is determined from the datum position of the sensor 32.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

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Thus, for example, the take-up mechanism might comprise gripper bars when the microprocessor would be programmed to present the leading edge to the gripper bars at the correct instant but at zero speed.

Again, for example, vacuum suction might be applied to the sheet in the stack above the sheet being fed to prevent the free-wheeling rollers from displacing that sheet prematurely or means may be provided to brake the free-wheeling rollers as soon as the sheet being fed clears them thus reducing the amount of correction which might otherwise be required by the microprocessor.

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**CLAIMS**

1. Apparatus for feeding sheet material sequentially on demand to processing machinery having a take-up mechanism comprising a feed table having a gate and upon which sheets may be stacked against the gate which allows only the lowermost sheet to pass therebeneath, means driven by a servo-motor to advance the lowermost sheet beneath the gate to the take-up mechanism, a sensing means between the gate and the take-up mechanism to detect the passage of the leading edge of the sheet, a microprocessor which receives data indicating the position of the take-up mechanism and from the sensing means and programmed to control the servo-motor to ensure that the leading edge of the sheet presents itself to the take-up mechanism at the correct instant.
2. Apparatus according to claim 1 wherein the microprocessor is programmed to ensure that the leading edge of the sheet presents itself to the take-up mechanism at a desired speed.
3. Apparatus according to claim 2 wherein the take-up mechanism comprises a pair of take-up rolls.
4. Apparatus according to claim 3 wherein the desired speed is slightly less than the speed at which the take-up mechanism forwards the sheet.
5. Apparatus according to claim 2 wherein the take-up mechanism comprises gripper bars.
6. Apparatus according to claim 5 wherein the desired speed is zero.

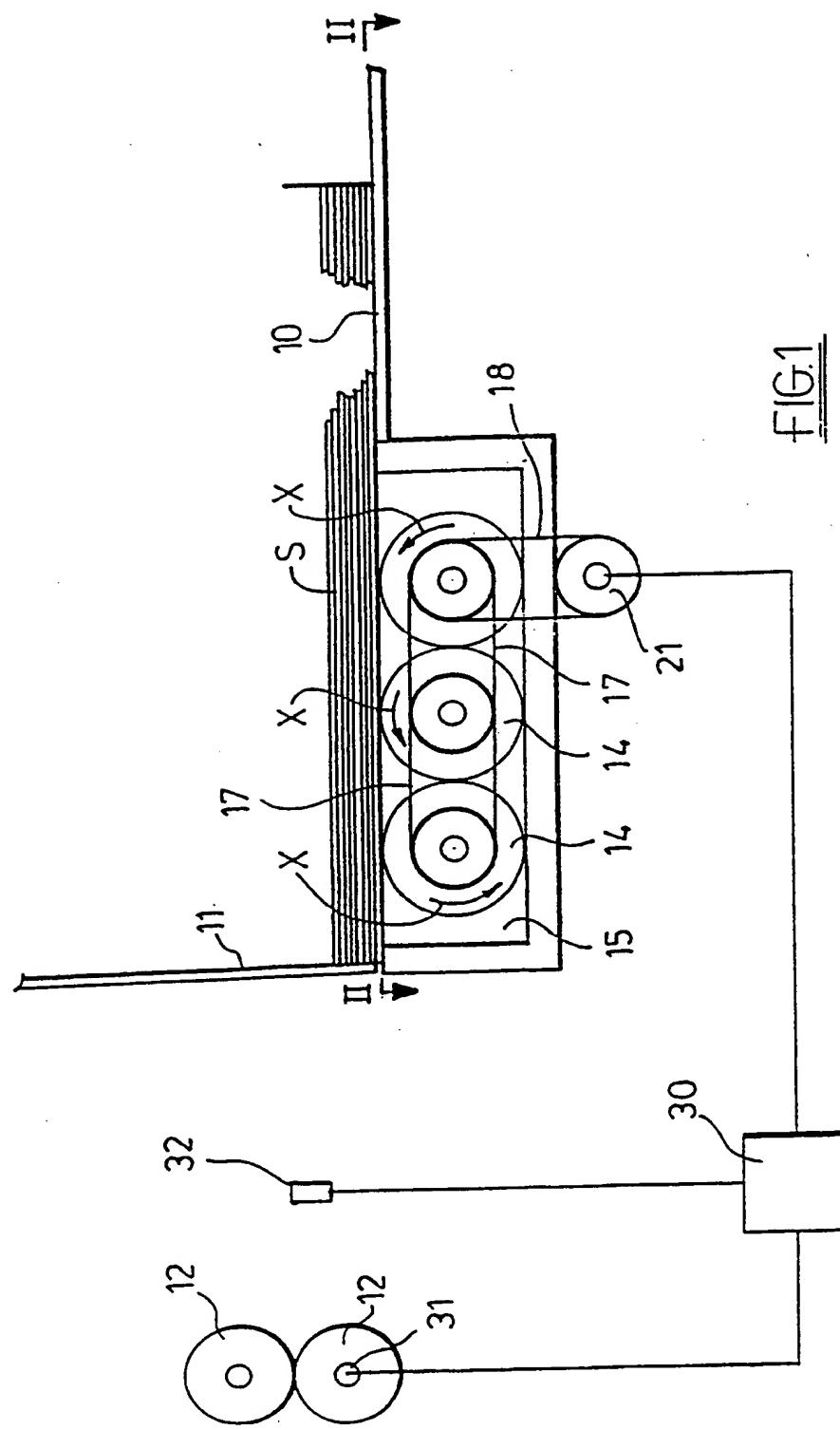
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7. Apparatus according to any preceding claim wherein the means driven by the servo-motor comprises a bed of rollers within the surface of the table which are rotatably driven to advance the lowermost sheet beneath the gate to the take-up mechanism when forward drive to the rollers is arrested and means to allow the rollers to free-wheel once the lowermost sheet is being advanced thereover by the take-up mechanism.

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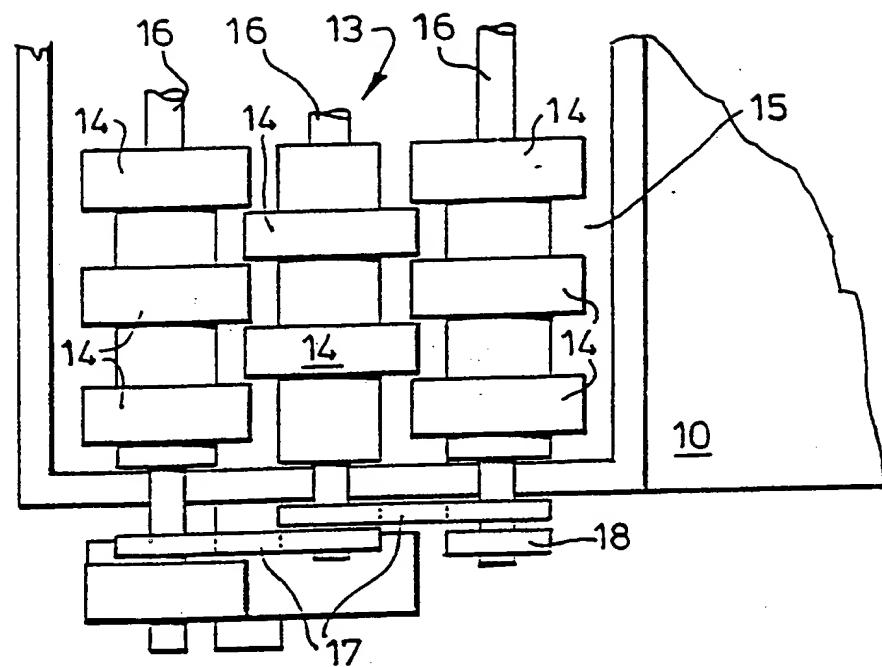


FIG. 2

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# INTERNATIONAL SEARCH REPORT

Int'l. Appl. No.

PCT/GB 99/02040

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7    B65H3/06    B65H7/18    B65H5/34

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7    B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 290 074 A (GD SPA) 13 December 1995 (1995-12-13) page 7, line 2 - page 9, line 10; figure 1 page 9, line 2 - line 6; figure 4	1-3
X	DE 196 40 963 A (HEIBER WOLFGANG ; SCHROEDER FRERKES JULIUS DR IN (DE)) 16 April 1998 (1998-04-16) column 4, line 8 - line 16; figure 3	1-3
A	US 4 131 273 A (KUFRIN FRED W ET AL) 26 December 1978 (1978-12-26) column 12, line 21 - line 42; figures 11,14	1,2,5,6
A	DE 43 29 124 A (HEIDELBERGER DRUCKMASCH AG) 2 March 1995 (1995-03-02) abstract; figures	5
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Patent family members are listed in annex.

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Date of the actual completion of the International search

Date of mailing of the International search report

2 March 2000

13/03/2000

Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

Inten xnal Application No  
PCT/GB 99/02040

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 11017 A (RAPIDEX SM ;GUIOT BERNARD (FR)) 27 March 1997 (1997-03-27) page 8, line 9 -page 11, line 7; figures 1,2	1,7
A	EP 0 414 157 A (RENGO CO LTD) 27 February 1991 (1991-02-27) column 3, line 25 -column 6, line 43; figures 1-3	1,7

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